Thermal Plotter used to assure proper EMR data collection

Technical Demonstration Summary Sheet
ELECTROMAGNETIC RADIOGRAPHY (EMR)

THE NEED

The Decontamination and Decommissioning (D&D) and environmental restoration operations at the Idaho National Engineering and Environmental Laboratory (INEEL) have a need for a method of detecting and identifying buried objects and soil contaminants that will reduce cost and employee exposures. Presently, INEEL performs bore sampling for soil characterization and uses field test kits for sample-as-you-go excavation activities to identify contaminants and to follow spill plumes to their unknown boundaries. If contaminants are suspected within an area, bore-sampling activities are statistically located within the given sample area. These methods are less than exact, labor intensive and expensive.

THE TECHNOLOGY

Electromagnetic Radiography (EMR) is a ground penetrating radar system used to perform 100% examination of potentially contaminated soil or buried objects. EMR is designed to identify subsurface soil anomalies caused by chemical contamination in a three dimensional representation. EMR minimizes surface soil disturbance, employee exposure, and the amount of personal protective equipment used. The EMR is also capable of locating solid buried objects such as piping, drums, and tanks. The cost for the EMR is dependent upon the target objects, type of terrain, and the total area to be surveyed. Mission Research Corp. of Albuquerque NM provides this characterization as a service ranging in cost from $5,000 to $12,000 per acre.

THE DEMONSTRATION

The EMR was demonstrated for two days at three different locations on the INEEL. Two locations at the Initial Engine Test (IET) facility near Test Area North were surveyed. The first, for potential Mercury contamination on an old railroad bed, and a second, at a fuel oil plume associated with an old fuel supply line. Both locations were approximately 10,000 square feet. The third application, at the INEEL Nuclear Technology and Engineering Center (INTEC) involved surveying for buried piping and utilities over approximately 60,000 square feet.

THE RESULTS

The EMR provided 100% coverage of the areas surveyed, a vast improvement over standard bore sampling activities currently used to characterize potentially contaminated soil. At IET preliminary results indicated the presence of a DNAPL (possibly Mercury where previous sampling had given negative results) and an LNAPL which is most likely fuel oil (this was unexpected) within the railroad bed. EMR results were inconclusive because the detection levels were below regulatory limits and the detection limits of the baseline laboratory instruments. The area surveyed at INTEC is very cluttered with buried utilities systems and process piping. Survey data was processed to create a map that compared favorably to historical data. The post-processing of data for underground piping and utilities is very time consuming and requires very close attention to detail. This led to the conclusion that although EMR is capable of 3D-mapping of underground piping and utilities, it is better suited for detection and mapping of underground chemical contamination. EMR provides a 100% area coverage which conventional sampling cannot do without tremendous costs. EMR covers the entire area enabling optimal sampling to obtain better results with fewer samples. In addition, EMR is a non-destructive examination that involves dragging an antenna across the soil surface minimizing soil disturbance, reducing personnel exposure, and reducing the personal protective equipment needed. With the use of EMR in conjunction with conventional sampling techniques, it appears sampling costs can be significantly reduced. Because these demonstration results were not conclusive, it is recommended that on-site spiked tests be performed prior to future characterization activities.

BENEFITS

- Reduced sampling costs.
- 100% coverage of sample area.
- Reduced personnel exposure and reduced amount of personnel protective equipment required.
- Sample location optimization and reduction of the number of samples required.

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The EMR antenna and tow vehicle, typical large area survey setup.